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NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

MBA PROFESSIONAL REPORT

FOREIGN MILITARY SALES PRICING PRINCIPLES FOR ELECTRONIC TECHNICAL MANUALS

by

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June 2004

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**FOREIGN MILITARY SALES PRICING PRINCIPLES FOR
ELECTRONIC TECHNICAL MANUALS**

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ABSTRACT

DOD Instruction 7000.14-R, paragraph 0716, prescribes the methods that will be used to determine the price of DOD publications when they are sold to foreign military sales (FMS) customers. The Instruction includes publication pricing factors that shall be included in the development of FMS prices for paper publications. When technical data was maintained and distributed primarily by paper form, pricing the product to recover the associated costs was a relatively reasonable and reliable process. As we transition from paper to electronic data encompassed in various media and arrangements, the costs associated with this migration will differ considerably. As electronic storage and presentation of digital data becomes more interactive with the internet, the association between the existing practices and advanced products become more contradictory. The historical pricing procedures will no longer reflect the costs that need to be recovered. In this era of digital data and computerized integration, new technological advances have increased the demand and cost of services associated with digitization of paper documents. With the introduction of these new technologies, various fees associated with this transformation have to be incorporated into the pricing structure that currently exists. The problem that exists with the incorporation of these fees is the lack of long-term historical data due to relative infancy of the goods and services linked to this technology. The primary objective of this project is to determine accurate and justifiable pricing for the foreign military sale of electronic technical manuals under the guiding principles of DOD Instruction 7000.14-R. is for the abstract.

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EXECUTIVE SUMMARY

All consumers desire a clear and concise pricing policy for the acquisition of goods and services. This desire stems from the concept of fairness and reasonability. The Foreign Military Sales Program serves two purposes, it is both an economic and political program aimed at establishing diplomatic and strategic alliances with various countries around the world. As technology continues to progress, the costs of phasing out archaic and legacy systems continue to grow. Included in the disposal of out-dated systems is the elimination of inefficient processes. Paper document storage, maintenance, and distribution are slowly being minimized in accordance with the modernization of computer and communications systems initiatives outlined in the 1997 Quadrennial Defense Review. As paper documents are being converted to digital data, the historical pricing policies do not accurately capture all pertinent costs related to this transition. DOD Instruction 7000.14-R, paragraph 0716, prescribes the techniques used to determine the price of DOD publications when they are sold to foreign military sales (FMS) customers. The primary objective of this project is to determine accurate and justifiable pricing for the foreign military sales of electronic technical manuals under the guiding principles of DOD Instruction 7000.14-R.

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I. BACKGROUND

A. INTRODUCTION

DOD Instruction 7000.14 outlines the methods for determining the price of DOD publications and technical manuals when they are sold to foreign military customers. This instruction includes pricing factors that shall be included in the development of foreign military sales (FMS) prices for paper publications. When technical data was maintained and distributed, primarily by paper format, pricing the product to recover the associated costs was a relatively reasonable and reliable process. In this era of digital data and computerized integration, new technological advances have increased the demand and cost of services associated with the digitization of paper documents.

As we transition from paper to electronic data encompassed in various media and arrangements, the costs associated with this migration will differ considerably. With the introduction of these new technologies, various fees associated with this transformation have to be incorporated into the pricing structure that currently exists. As electronic storage and presentation of digital data become more interactive with the internet, the link between the existing practices and advanced products become more contradictory.

Historical pricing procedures will no longer reflect the costs that need to be recovered. The problem that exists with the incorporation of these fees is the lack of long term historical data due to the relative infancy of the goods and services linked to this technology. The accuracy and reasonableness of commercial pricing for various goods and services in government contracting are determined by the adequacy of competition. In the absence of sufficient competition, government contractors must conduct thorough research and analyze the marketplace to determine a fair and reasonable pricing policy for all procurements.

B. FOREIGN MILITARY SALES

The Foreign Military Sales (FMS) program is the process by which the US government sells various materials and services to foreign governments via trade agreements and treaties. This program enhances the economic prosperity of the United

States by stimulating trade and strengthening alliances between the US and its allies. This also promotes joint interoperability between the US and its foreign allies in the arena of military equipment.

The Arms Control Export Act regulates the FMS program. Countries participating in the FMS program must meet all eligibility requirements and comply with regulations of the State Department, Congress, and Arms Control Export Act(AECA). Although the State Department monitors and administers the FMS program, Congress has regulatory oversight of the program and veto powers detailed in section 36(b). Congress must be notified and has the power to disapprove if the US government intends to propose a letter of offer and acceptance (LOA) when: defense articles or services are valued at \$50 million or more, design and construction services are worth \$200 million or greater, and major defense equipment are valued at \$14 million or more.¹ Electronic tech manuals would not warrant any Congressional oversight because they fall below the required thresholds. The elimination of Congress as a participant in the approval process for electronic tech manuals shifts total administrative control to the State Department, Department of Defense, and regional FMS offices.

Once an LOA has been signed, the process of obtaining the final product for export could travel through a myriad of logistics channels and agencies prior to delivery. For complex weapons systems, the delay between an LOA and delivery could be a year or more. The reason for this delay is because DOD has to purchase the items from US manufacturers through its procurement channels and then the complex interagency process begins between the DOD and State Department.

The 21st century has brought about a technological revolution with the implementation and integration of the internet in so many aspects of business. The internet spawned the origin of electronic commerce as well as numerous applications and software that aid in the conduct of business via the internet. This revolutionary transformation of business practices has spread into all aspects of both commercial and government business practices including FMS.

¹ Arms Control Export Act

The Supply Discrepancy Report was the first electronic commerce business application developed, specifically by the Navy, for use on the World Wide Web.² An online system was developed to permit FMS customers to submit requests for all types of requisitions. As a result of this system, various internet database applications and information warehousing programs were generated to support the Navy in its transition into the realm of electronic commerce. A key system that spawned from the various electronic commerce applications was the FMS Initial Support Tracker.³ This system allows government contractors in the FMS field to track spares, publications, and support equipment from identification to initial operating capacity for foreign customers. These innovations along with several pending initiatives are reducing the administrative lead-time and continuous requirements associated with FMS.

C. DIRECT COMMERCIAL SALES

The direct commercial sales program allows foreign customers to purchase military and commercial products and services directly from US manufacturers. AECA provides guidance, policies, and procedures by which transactions are conducted in this program. The State Department is the government agency responsible for oversight and regulation, as well as licensing requirements. US companies must obtain an export license, which is issued by the Office of Defense Trade Controls, under the supervision of the State Department's Bureau for Political Affairs.⁴ There is a four year time limit on the life of an export license; therefore, delivery schedules are critical between renewal cycles. Delays and cancelled orders can result from slow turn around time by the licensing agency. The State Department approximates that only half of the export licenses issued result in delivery of products to foreign customers.⁵

Direct Commercial Sales are primarily for countries that have a wealth of experience and knowledge in both Foreign Military Sales and Direct Commercial Sales program. These countries could find the Direct Commercial Sales program more useful due to urgency or possible reduction in overall costs due to the lack of government

² Kittredge, Ken, "Navy FMS eBusiness". DISAM Journal Summer 2000

³ Kittredge, Ken, "Navy FMS eBusiness". DISAM Journal Summer 2000

⁴ DCS: Direct Commercial Sales, <http://www.ciponline.org/facts/dcs.htm>

⁵ United States, Arms Control and Disarmament Agency, "Article: Revision of US Arms Data Series" Jan 1999

administrative charges. The administrative tasks associated with this program are the responsibility of the US manufacturer. Foreign participants in this program rely upon the expertise and influence of the US manufacturer to expedite the products within the time constraints allowed by their governments. Overall, the Direct Commercial Sales program is a tool for the more veteran foreign governments who have critical needs of a pressing nature and want to save time and exercise more control and power during pricing negotiations.

D. PAPERLESS SERVICE INITIATIVES

In May 1997, the Quadrennial Defense Review (QDR) was released and several initiatives were outlined for the Department of Defense (DOD). Among the initiatives was modernization of critical computer and communications systems. Also, the Defense Department sought to streamline and improve the acquisition infrastructure across all service branches by adopting the best practices from the commercial business sector. As a result of the 1997 QDR, the Secretary of Defense generated the *Defense Reform Initiative: The Business Strategy for Defense in the 21st Century* in November 1997. The purpose of this document was to devise a defense strategy for the 21st century with “military forces able to meet the challenges of the new era.”⁶ The Secretary of Defense further added, “there is no alternative to achieving fundamental reform in how the Defense Department conducts business.”

There were a series of memoranda and instructions generated at various levels within the Defense Department as a result of this document. In November 1999, the Department of the Navy released its policy on digital logistics technical data under the directives of *Guidance on Acquisition and Conversion of Logistics Technical Data to Digital Form* and DOD Regulation 5000.2-R. The Navy outlined five primary objectives in the conversion of legacy technical data in paper format to an integrated electronic media: develop and implement a plan for on-line access to logistics technical data in digital form, convert existing paper copies to digital forms consistent with DOD standards in a cost effective manner, establish an integrated digital data environment that supports the Department of the Navy acquisition system, maintain strict compliance with

⁶ Dept of Defense, “Defense Reform Initiative: The Business Strategy for Defense in the 21st Century”, Nov 1997

existing security procedures for handling classified data, and apply best practices in business to reduce the costs associated with the implementation of this system.⁷ The purpose of these sweeping changes was to promote cost efficiency and improve the existing processes within DOD. All entities within DOD were compelled to produce and put into practice a practical plan for modernization and converting paper copies to an integrated electronic format.

The Department of the Navy released an updated draft revision of the *Guidance on Acquisition and Conversion of Logistics Technical Data to Digital Form* in November 2002. Several criteria have been updated to reflect the changes in technology since the release of initial guidance in 1999. Technology is advancing at an alarming rate and software obsolescence, as well as software compatibility conflicts, will become a vital area of interest in the near future.

In addition to the numerous service initiatives concerning digitization of products and process, DOD contracting was a special area of interest and was included in many of the acquisition reforms that have taken place over the last seven years. The Defense Federal Acquisition Regulations (DFAR) has been updated to reflect some of the changes associated with paperless contracting. Clause 252.232-7300 (232.7400) requires contractors to submit all payment requests electronically through the approved DOD channels.⁸

⁷ Assistance SECDEF for Research, Development, and Acquisition, “DON Policy on Digital Logistics Technical Data”, Nov 1999

⁸ Defense Federal Acquisition Regulations 252.232-7300

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II. LITERATURE REVIEW

A. INFORMATION TECHNOLOGY LABOR MARKET

To successfully introduce or recommend an accurate pricing policy for electronic technical manuals, one must understand the labor practices of the industry and intellectual capital connected with the production of these products. The electronic technical manual, and its integration with the internet, relies upon legacy data and emerging technologies. As technology becomes more sophisticated, the life cycle costs for electronic technical manuals could increase dramatically. The increased life cycle costs will result from software obsolescence and replacement issues and an unstable labor market in the information technology sector. The labor cost for qualified personnel in the information technology sector is constantly rising.

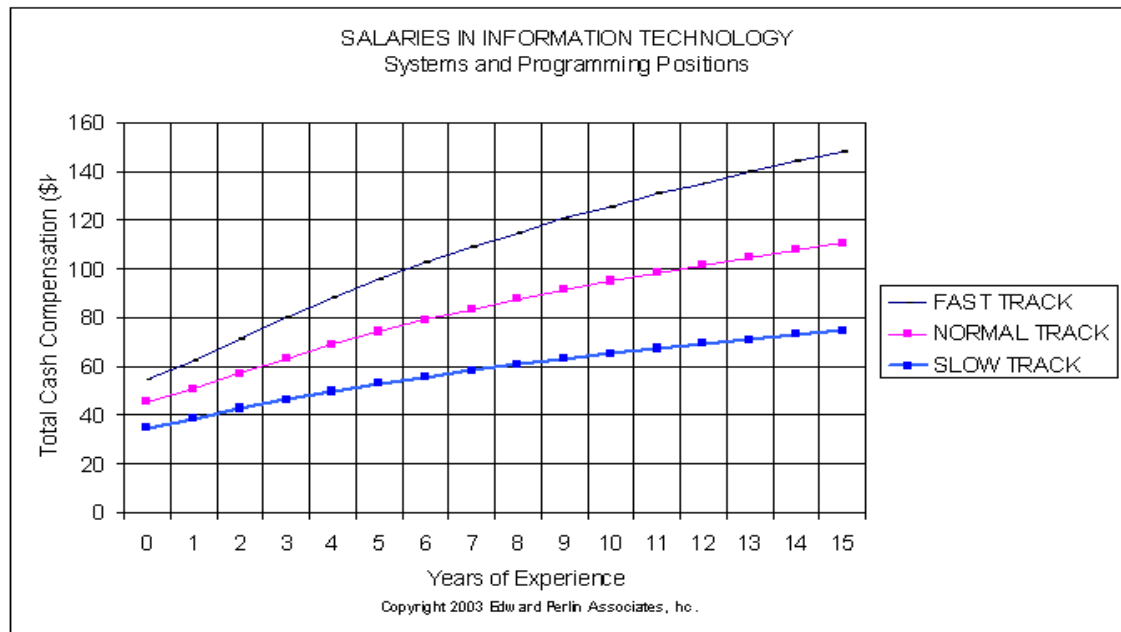


Figure 1. Information Technology Sector Salary Trends⁹
(Source: Edward Perlin Associates)

⁹ Edward Perlin Associates, "Information Technology Professional Salary Survey", Copyright 2003, <http://perlinsurveys.com/newscopy.html>

The average salaries for information technology (IT) personnel are listed below:

Occupation Title	Employment (1)	Median Hourly	Mean Hourly	Mean Annual (2)
Computer and Mathematical Science Occupations	2,772,620	\$28.13	\$29.63	\$61,630
Computer and Information Scientists, Research	24,410	\$37.38	\$38.71	\$80,510
Computer Programmers	457,320	\$28.98	\$30.62	\$63,690
Computer Software Engineers, Applications	356,760	\$34.09	\$35.48	\$73,800
Computer Software Engineers, Systems Software	255,040	\$35.60	\$36.46	\$75,840
Computer Support Specialists	478,560	\$18.80	\$20.35	\$42,320
Computer Systems Analysts	467,750	\$30.24	\$31.20	\$64,890
Database Administrators	102,090	\$26.68	\$28.41	\$59,080
Network and Computer Systems Administrators	232,560	\$26.35	\$27.70	\$57,620
Network Systems and Data Communications Analysts	133,460	\$28.09	\$29.51	\$61,390
Actuaries	14,440	\$33.64	\$38.84	\$80,780
Mathematicians	2,600	\$36.77	\$36.35	\$75,610
Operations Research Analysts	56,310	\$27.36	\$29.27	\$60,890
Statisticians	17,820	\$27.44	\$28.85	\$60,000
Mathematical Technicians	1,970	\$17.56	\$20.64	\$42,920

Table 1. 2002 Median salary figures for Computer and Mathematical Occupations.
(Source: Bureau of Labor and Statistics)¹⁰

The IT labor market is unstable because of increased competition for market share among many different technology firms. The barriers to entry in the IT sector are

¹⁰ Bureau of Labor and Statistics, www.bls.gov, 2003

minimal because of the flexibility of the industry. Intellectual capital is the driving force in the IT world due to the scarcity of advanced computer programmers. In a recent survey of twenty-eight IT companies, nine indicated that they recruit for IT positions outside the United States.¹¹ The survey also indicated that nine companies provide benefits such as flexible hours, flexible days, and telecommuting. This information is useful because facilities costs and overhead can be minimized or significantly reduced for companies providing this benefit.

There was one disturbing statistic from this survey. Despite the recent myriad of corporate scandals involving excess executive compensation, incentive bonuses were awarded to employees and the breakdown is detailed below:

Incentive/Bonus Award Levels

2003 Reported				2004 Estimated		
	# Companies	Average	Range	#Companies	Average	Range
Professional	22	7.9%	0.0%-18.9%	22	7.5%	0%-25%
Mid Mgt	24	13.0%	2.7%-25.0%	24	12.5%	0%-30%
Sr. Mgt	23	27.8%	0%-103%	23	25.0%	0%-100%

Table 2. Information Technology Professional Salary Survey.
(Source: Edward Perlin Associates)

The bonuses awarded to middle and senior management drive up labor costs and increase overhead. Cost allocation should be examined carefully for companies that award large bonuses to its executives and upper echelon. A detailed work breakdown structure must accurately reflect the roles and responsibilities of management in the overall production process for generating electronic technical manuals.

Specific plans of action and milestones should be generated by potential bidders detailing the role of management in the production cycle. Management not deeply involved in the project, but whose labor hours are disproportionately charged to the

¹¹ Edward Perlin Associates, "Information Technology Professional Salary Survey", Copyright 2003, <http://perlinsurveys.com/newscopy.html>

project for a minimal role, should be subjected to a serious examination. The inquiry should determine if their labor hours are allocable and allowable under the FAR. This is a grey area that could unjustly subject some contractors to undue administrative requirements; however, it will bring about more carefully planned quotations from most contractors.

B. ELECTRONIC TECHNICAL MANUALS

The origin of the electronic technical manual was a direct result of the development of early computer programs and languages designed to digitize large volumes of data. Standard Generalized Markup Language (SGML) is a computer language used to define other languages. It was developed in the 1970s for use by large corporations to store massive quantities of paper documents.¹² The program was developed with the flexibility to represent the content of small documents in addition to enormous and multifaceted documents such as technical manuals. From SGML, Hyper Text Markup Language (HTML) and Extensible Markup Language (XML) were developed. HTML is the language that is used to design and disseminate digital information on the World Wide Web. XML is a simplified version of SGML with enhanced features designed to integrate the functions of SGML with the World Wide Web. Digital publishing industry experts have accepted XML as the standard program for generation of electronic technical manuals in accordance with the recommendations of the World Wide Web Consortium (W3C) in 1998.¹³

Interactive Electronic Technical Manuals (IETM) performs a variety of tasks and is divided into different classes according to the functionality. IETMs provide an assortment of utilities and interface properties that allow users to complete a vast array of tasking. The sophistication and diagnostic capabilities of IETMs depend on the class.

C. CLASSES OF IETM

There are six recognized classes of ETM ranging from non-indexed page images (scanned) to an integrated database information system.

¹² Zalane, Osmar R., "Web Technologies and Applications", Winter 2001

¹³ World Wide Web Consortium, www.w3c.org

- **Class 0.** Non-Electronically-Indexed Page Images - Systems of digital page images that are intended for electronic archival filing or Print-on-Demand. Pages can be viewed in an electronic display but have no index for navigation through the document for the purpose of on-line usage.
- **Class 1.** Electronically Indexed Page Images - Systems of digital page images intended for full-page display. Automatic intelligent indexing allows navigation to the page images for user access. These systems can be used in a library or reference setting for reading and research use. They can be printed directly.
- **Class 2.** Electronic Scrolling Documents - Systems for interactive display of ASCII-based documents using intelligent indexing and Hypertext tags inserted into a tagged document file. This type of document is generally the result of a simple conversion from a page-oriented document with the addition of Hypertext tags. This allows navigation of the document by the user, however, content driven NEXT function and author inserted navigation aids are very limited, if any. The NEXT function instructs the logic engine to continue executing the process data module until a new data module or dialog is to be presented. The NEXT function allows for efficient authoring of alternative information and rule-based diagnostics.¹⁴
- **Class 3.** Linear Structured IETMs - Interactive display of technical information, which is in SGML format to the maximum extent possible and using a Hypertext presentation system for display. Rather than being based on a hierarchically based Data Base, it is based on a linear SGML document file. Navigation is based on content driven logical NEXT function and author developed constructs employing prompted dialog boxes.
- **Class 4.** Hierarchically Structured IETMs - System for interactive electronic display of technical information specifically authored into and maintained in a relational or object-oriented hierarchical data base with no redundancy of data. The data is then packaged as a run-time database for interactive presentation (IETP).

Class 5. Integrated Data-Base IETIS - Integrated Electronic Technical Information System for interactive presentation of Class 4 IETMs integrated in with data

¹⁴ ManTech Advanced Technology Systems, "Final Potential/Desirability Survey Report for the DOD CALS IDE Project" January 29,1996

for other processes and systems for information display and user-applications such as computer aided training or fault diagnostics.¹⁵

D. CREATION OF AN IETM

The process of creating an IETM is very intricate and protracted. Creation of an IETM requires a tremendous amount of preparation and labor. The entire generation procedures for both government and commercial sectors differ by infrastructure and regulations that govern business practices. The government is capable of creating IETMs; however, acquisition reforms require the use of commercial entities to the maximum extent possible. This section will examine the government and commercial processes for creating an IETM.

E. GOVERNMENT PROCESS

Government agencies manage and create IETMs based on two major processes, the Government Concept of Operations (GCO) and the IETM Concept of Operations (CONOPS). Foreign customers in the FMS program are usually well educated on some of the intricacy and complexity of government procedures and regulations; however, the level of effort required to execute and implement those regulations may not be apparent. There are costs associated with gathering and disseminating information to various parties during the entire acquisition process. The GCO is a document that identifies key tasks and requirements for the acquisition planning process. This document attempts to capture all the necessary and relevant information for a successful procurement.

The flow diagram of the GCO development process is illustrated below¹⁶:

¹⁵ Mekon Publishing, www.mekon.com/aerospace/ietm.htm

¹⁶ Defense Systems Management College Press, "Interactive Electronic Training Manual Guide, First Edition", FT Belvoir, VA, September 1999

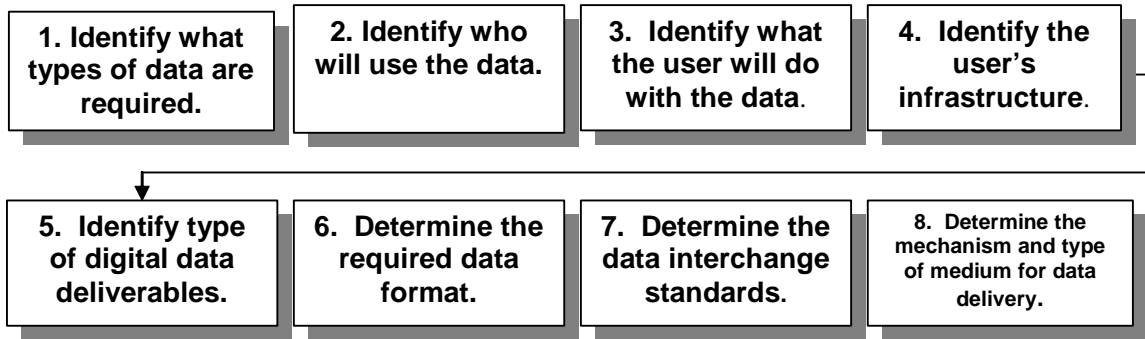


Figure 2. Government Concept of Operations Development Process
(Source: Interactive Electronic Training Manual Guide)

Once the document is generated based on the process above, it can provide a wealth of information to the Program Manager, as well as the entire Integrated Planning Team, when applicable. A meticulous GCO seeks to identify and collect data such as hardware and software systems currently in use throughout various Government agencies and facilities that can support and/or manage the IETM being acquired. End user special requirements based on the type and amount of data within the IETM, the reliability of the IETM, how frequently the information will be used and disseminated, and how that data will integrate with other systems currently utilized by the end user (this issue is addressed in more detail in the IETM CONOPS). In addition, this document should identify the format and media through which the IETM will be distributed, and life cycle costs associated with the acquisition, distribution, and ultimate disposal of the system. This document is generated during the acquisition planning phase of the procurement process. As previously mentioned, there are costs associated with unearthing and disseminating information collected during the GCO process.

The process is defined; however, the scope and level of effort is not defined and will be different for every acquisition. The number of people and related expertise will also vary based on the class of the IETM. The greater the complexity of the IETM, the more software experts will be needed to accurately capture the end users requirements. The price will vary, but a policy can be generated based on the whole process and not the individual tasks within the process.

GCO is a very labor intensive operation and requires a tremendous amount of resources (primarily current, accurate, and complete information), as well as a cooperative spirit across Government agencies. Although the breadth of this operation varies, the process of generating a GCO document requires only direct labor (pay, fringe benefits) plus overhead (travel, long distance phone calls, video teleconference, etc..). These costs can be captured and properly allocated based on the level of effort needed to obtain all the necessary and relevant information. DOD Instruction 7000.14R does not specifically address GCO document preparation as a cost; however, it can be incorporated into the acquisition cost or added as a special cost. FMS customers must realize that they are paying for professional acquisition services. The level of effort and costs associated with that effort is not always apparent; therefore, the costs must be identified and appropriately allocated in order to be fair and reasonable to both the Government as well as all FMS customers.

1. Other Government Acquisition Costs

The GCO's main purpose is to aid the acquisition team in: capturing the scope of the procurement, recognizing assets that are currently available within the Government, looking at end user requirements and infrastructure, summarizing probable life cycle costs, and identifying potential risks associated with the procurement of the IETM. The GCO development process in contracting terms is the Acquisition Plan. The Acquisition Plan outlines the acquisition strategy, roles and responsibilities of all parties involved, and the costs associated with acquiring the product and/or services. Acquisition planning is mandated by the Government via the Federal Acquisition Regulations (FAR). FAR Part 7.102 states:

Agencies shall perform acquisition planning and conduct market research for all acquisitions ...This planning shall integrate the efforts of all personnel responsible for significant aspects of the acquisition. The purpose of this planning is to ensure that the Government meets its needs in the most effective, economical, and timely manner.¹⁷

Although the FAR mandates Acquisition Planning, it still makes good business sense to have a plan in place for acquiring goods and services.

¹⁷ Federal Acquisition Regulations Part 7.102

Risk Management is a crucial aspect of acquisition planning. Risk Management can include every aspect of the acquisition from technical approach, performance, and market conditions. There are other risks associated with FMS programs and one of the most vital risks in FMS programs is a security risk. The inadvertent transfer of sensitive or classified information must be avoided during FMS transactions.

There are costs associated with maintaining classified and sensitive information. Most of the costs associated with classified and sensitive information should be a sunk cost for the government since the National Security Agency is responsible for classifying all government documents. Some of the documents used in IETMs must be “sanitized”. Sanitizing is the removal of sensitive and/or classified information to make a document(s) available for release to foreign governments without compromising the integrity and security of United States Government information systems. The only labor associated with “sanitizing” information in the IETM is the removal of any information that is deemed classified or sensitive. This labor does not require an extraordinary amount of technical expertise, but it requires tremendous attention to detail and a security clearance. According to a recent article in the Washington Post,

The government’s backlog of defense security clearances, estimated to be as much as 270,000, is raising the salaries of those who hold them by 15 percent and costing taxpayers hundreds of millions of dollars each year.¹⁸

This is an unforeseen cost in the acquisition process that was created as a result of events not directly related to the acquisition of IETMs. In order to maintain the principle of fair and reasonable to FMS customers, the Government will have to absorb proliferating sanitation costs because the security clearance backlog was created by the Government.

2. IETM Concept of Operations (CONOPS)

The second major process that provides guidance on generation of IETMs is the IETM CONOPS. The IETM CONOPS assists the Program Manager with determining the IETM Class and level of functionality. There are three critical areas that determine the Class of IETMs: functionality, standards, and data structure. Functionality identifies

¹⁸ Bergman, Hannah, “Security Clearance Backlog Proves Costly”, The Washington Times, May 06, 2004

all the capabilities and desired performance specifications needed to support the end users. Standards ensure software is developed to facilitate transportability and integration with current software/hardware systems and comply with the latest Government and industry practices. The Institute of Electrical and Electronics Engineers (IEEE) is one of the leading technical organizations that regulate software engineering standards. These standards are universally accepted by both government and industry participants.¹⁹

Data structure allocates the methodology for constructing and managing the data in a cost effective manner throughout its entire life cycle.

The IETM Functionality Determination Model incorporates all the factors, risks, and assumptions that devise the overall execution strategy. Each decision acts as an enabler, facilitator, or constraint on other decisions. Functionality will have a critical impact on: cost and schedule required for converting data from various forms to a single format, the accessibility of all pertinent functions to the end user, the costs to maintain and update the data, the ability to interface and interact with other data files, and the capacity to incorporate more advanced technology in the future.²⁰

The IETM Functionality Determination Model is illustrated below:

¹⁹ Institute of Electrical and Electronics Engineers Software Engineering Standards Zone, <http://standards.ieee.org/software>

²⁰ Defense Systems Management College Press, “Interactive Electronic Training Manual Guide, First Edition”, FT Belvoir, VA, September 1999

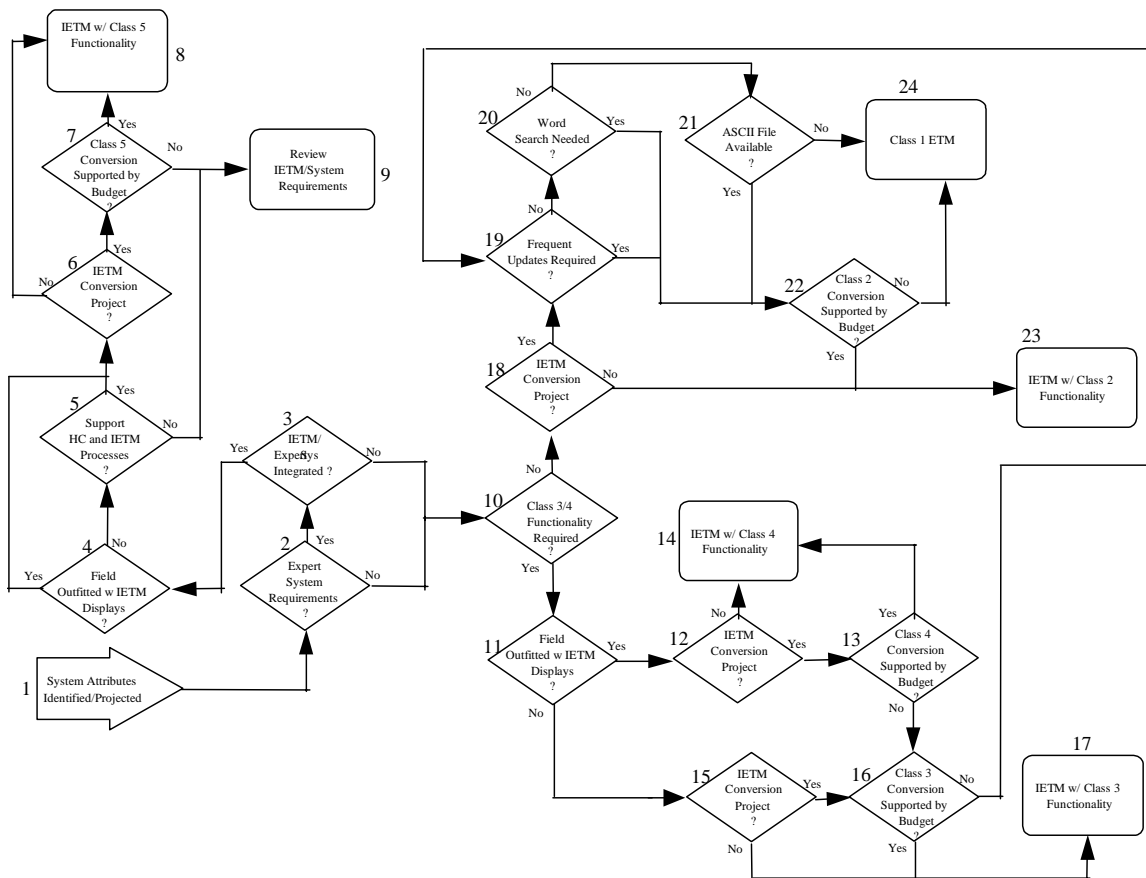


Figure 3. IETM Functionality Determination Model.
(Source: Interactive Electronic Training Manual)

The IETM CONOPS acts as a guide in distinguishing and forecasting the features of the hardware system that will be supported by the IETM, regardless of whether the hardware system is already fielded or in the process of being acquired. This model identifies areas of conflict and cohesion and the output can be used to identify and estimate the important cost drivers for the IETM. There are 24 steps identified in the IETM Functionality Determination Model. The model is represented graphically as a process flow chart consisting of 24 activities linking the path and precedence as it relates to the overall functionality of the end product. The 24 steps evaluate everything from budget constraints as it relates to data conversion costs for legacy data and systems to the availability of compatible data for incorporation into the final product.

GCO and IETM CONOPS are the processes that the Government uses to develop and plan the acquisition of IETMs. Using these processes, several areas of the acquisition planning process are identified and implemented. GCO aids in the development of the Request for Proposal (RFP) from potential offerors as well as identifies resources within the Government. In addition, GCO clearly identifies the level of effort required during acquisition planning and this is crucial to FMS customers because it reveals the breadth and scope of professional services that they are obtaining by using the program. IETM CONOPS uses a series of interrelated steps based on the availability of up to date data and budget constraints to determine the maximum amount of functionality for the end product. The 24 steps analyze the overall structure of the final product and recognize areas of unity and disagreement. This series of steps give support to the Statement of Work and Statement of Objectives as well as the performance metrics for the overall acquisition strategy. The Government process for acquiring IETMs is process driven with clear goals for a final product. The process defines the limits for the end user and compels the end user to be realistic in his/her expectations for functionality based on data availability and budget constraints.

F. COMMERCIAL INDUSTRY PROCESS

Commercial practices and processes for any acquisition are usually proprietary and not available for release outside individual companies. This was a limiting factor for this professional report because only one company out of twenty-eight (including IBM, Oracle, McGraw-Hill) contacted responded to the group's request for information. Mr. Harry Porthouse, Director of Sales and Marketing for Dayton T. Brown Inc., Technical Communications Division was the sole respondent for the commercial industry for this report. Most of the questions such as detailed processes for the creation of an IETM, work breakdown structure for IETM project teams, and cost drivers for IETMs was proprietary information. Mr. Porthouse explained in a phone interview that it costs money for the company to generate the information sought by the group and it had no cost benefit to the company and could not be justified internally. He further added that most of the information that the group wanted was proprietary and some of the

information is not well documented. Mr. Porthouse did provide some insight on some of the cost structure elements²¹. He stated,

The government does not want to pay companies for all the expenses associated with operations. The government does not account for the fringe benefits and the marketing costs associated with attracting and retaining the most talented people. The government accounting system wants you to identify costs based on direct labor, indirect labor, direct material, and G&A costs. There are certain intangible costs that are difficult to capture such as retention pay and benefits for programmers that may not be allowable under government regulations, but they are necessary due to the volatile nature of the industry. The additional retention pay would come out of the company's profit, thus reducing its Return on Investment.

Mr. Porthouse was extremely helpful in identifying an area of concern that needs to be addressed if the Government seeks to obtain the best value from companies, especially in the IT sector. Inadvertent reduction of the vendor base due to FAR and other government regulations may cause prices for developmental software products to exceed commercial marketplace pricing due to minimum competition. Reduced profit margins and return on investment is causing many high-tech companies to shy away from government contracts. Although Mr. Porthouse was not able to provide any detailed work breakdown structures or pricing policies, this group was able to find a presentation from a commercial company via the internet.

There were several companies that provided detailed solutions in capturing the current industry work breakdown structure and their proposed solution to streamline the process using a single solution and universal programming language, Extensible Markup Language (XML). All legacy data will be converted to XML to significantly decrease compatibility and integration issues with other systems. Arbortext provided a single source solution to modernize current industry practices in the realm of generating IETMs

²¹ Phone Interview conducted on 31 March 2003.

1. Arbortext's View of the Industry

Existing Information Processes

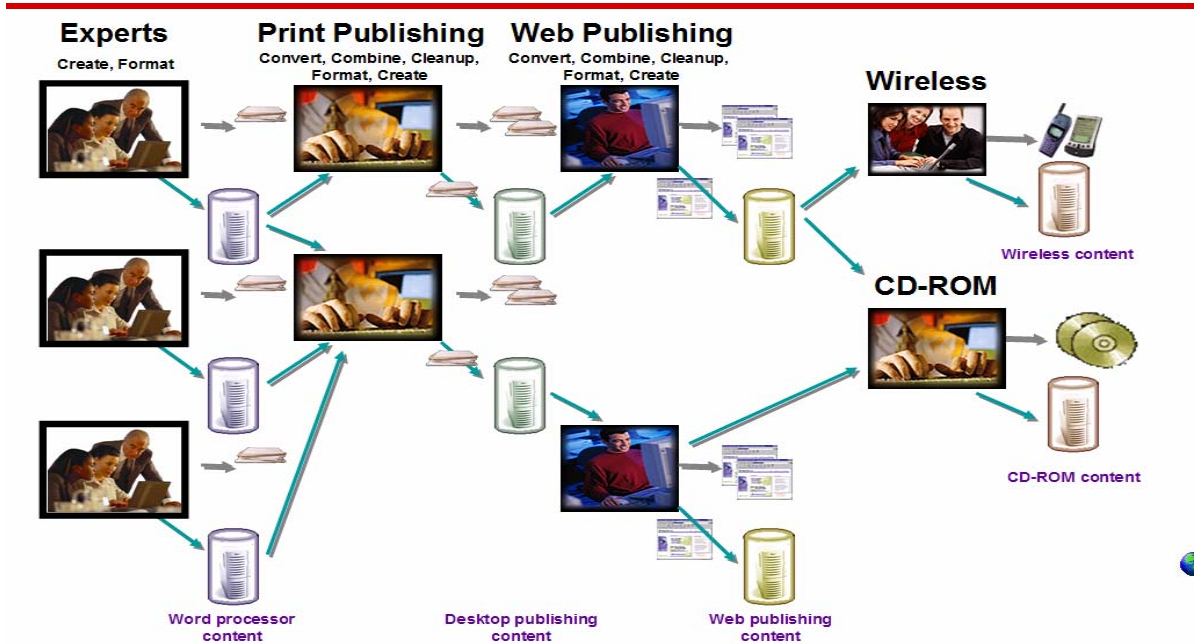


Figure 4. Arbortext view of current industry practices

(Source: Arbortext Presentation, "Building the Business Case for XML and Single Source Content"²²)

Arbortext views industry practices as redundant and wasteful. The technical expert teams each generate their own design approach to generate an IETM. The technical approaches are then consolidated and standardized according to current industry specifications and then transferred to two separate web publishing teams. One team is responsible for distributing the final product via the web and the other team is responsible for the wireless networking distribution of the IETM. Both teams are capable of producing CD-ROMs for distribution via parcel service or regular mail. There are costs connected with maintaining a redundant infrastructure. The excess capacity generated by industry practices must be paid and these costs are passed to the customers.

²² Bartlett, PG "Building the Business Case for XML and Single Source Content", February 21, 2002, www.arbortext.com/html/white_papers_webinars.html

2. Arbortext's Proposed Solution

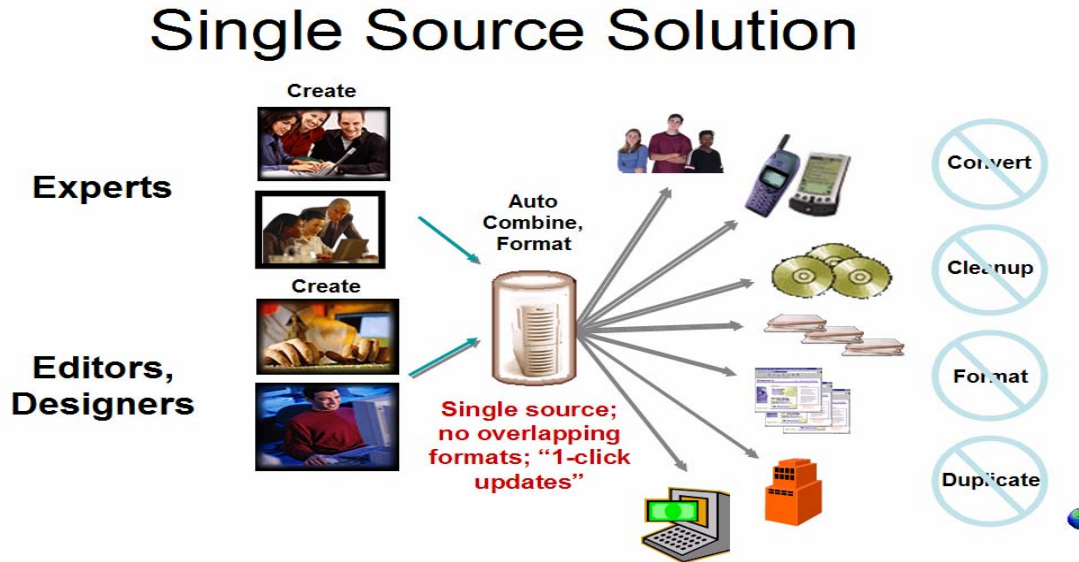


Figure 5. Arbortext's Proposed Single Source Solution
(Source: Arbortext Presentation, "Building the Business Case for XML and Single Source Content")

Arbortext's solution to resolving the excess capacity and redundancy issues is the formation of an IPT consisting of functional experts working on universal standards and a universal programming language for a single solution. This proposed solution allows each functional area of expertise to concentrate on a single design and implementation process. Since the programming and data standards would be mandated and universal then a great deal of the integration and reliability issues should be resolved. A consequence of using a universal language and standards would be the eventual automation of solutions based on a collective solution from the IPT. Once these systems become fully automated then the entire process should generate significant savings in terms of costs and time.

There is a problem associated with the proposed single source solution; cost identification. By adopting this single source solution cost, one could possibly lose track of allocable and allowable costs. Since the functional experts are working on an IPT, it is difficult to certify times for individual tasks within the IPT. The difficulty arises because

there is not a baseline for determining the required level of effort and individual task times for IETMs; however, one can look at previous similar acquisitions over a period of time and establish an industry average.

Some of the cost savings realized from the single source solution should be passed to consumers. Companies should retain the majority of the savings to recapitalize their equipment and to maintain a healthy labor base by providing incentives for existing technical experts and funding to recruit new software developers.

III. ANALYSIS

A. PRICING MODELS FOR IETM

1. Current DoD Pricing Model²³

$$\frac{(AC + CPC + SC)}{Q} = \text{Price per copy}$$

Acquisition Cost (AC) is the contractual and in-house DoD costs required to deliver a reproducible master which includes, but is not limited to, the amounts paid for technical or administrative writing, editing, illustrating, animation, and copy preparation.

Copy Production Cost (CPC) is the costs incurred in printing or reproduction of copies from the reproducible master.

Special Cost (SC) is the costs incurred in sanitizing documents, classified handling, development and maintenance of country-specific publications.

Quantity (Q) is the total number of copies of IETMs produced.

2. Proposed Pricing Model

To accurately capture all relevant costs during the procurement process, one must take a careful look at all the actual costs incurred during the production and support of an IETM. The life cycle costs of acquiring IETMs have both recurring costs and non-recurring costs. Some of the recurring costs not addressed in the current DoD pricing model are costs for web-based distribution such as annual website hosting and maintenance fees, domain name registration fees, and search engine registration costs. Some of the non-recurring costs are the website building costs and data conversion costs to allow data transmission via the internet. Those costs are not accurately captured in the current pricing model for IETMs. There are several solutions available for different classes of IETMs. Web-based solutions will require accounting for numerous costs that were not predicted with the proliferation of the internet. There are site development costs. These are the costs to build the website and make it suitable for e-commerce. In

²³ DODINST 7000.14-R “DOD Financial Management Regulation, Volume 15 Chapter 7”, August 2003

addition to development costs, there is hosting, maintenance, internet access, domain name registration, and search engine registration costs for websites. The median costs across the commercial industry for building a website is listed below²⁴:

Median price quote (per hour)			
Service	1999	2000	2002
ASP/Cold Fusion, coding	N/A	N/A	\$150
Basic HTML	\$110	\$110	112
CGI scripting	150	160	N/A
Copy writing	115	125	123
Database administration	195	200	165
Design	150	150	125
Flash	N/A	N/A	138
Java/Shockwave	200	165	N/A
Project management	N/A	150	150
Strategy	175	185	195

Table 3. Web Price Index
(Source: BtoB Online. <http://www.btobonline.com/>)

For web-based solutions there must be two separate and distinct costs for IETMs, the acquisition and development costs and the subscription costs to maintain the availability of the IETM. The majority of the costs associated with building the website should be absorbed by the government as a cost of doing business. Web-based solutions must be carefully analyzed for feasibility and cost-benefit to the government. The benefits of the solution must outweigh the costs of building and maintaining the web-based infrastructure.

As previously mentioned, there are several costs associated with the acquisition and development of IETMs. This is a categorization of all relevant costs related to the acquisition of IETMs:

²⁴Carmichael, Matt, "Web Price Index: Web site development costs stabilize; developers focus on projects from existing customers" September 09, 2002.

Acquisition Costs are the contractual and in-house DoD costs required to deliver a reproducible master, which includes, but is not limited to, the amounts paid for technical or administrative writing, editing, illustrating, animation, and copy preparation. In addition data conversion, market research, and software costs should be included in the acquisition cost category.

Copy Production and **Special Costs** should remain the same.

The largest point of contention for the current pricing model is the equitable division of all the costs above. These authors contend that quantities produced are not an accurate or reasonable method of allocating overall acquisition costs. Special software available in the commercial marketplace allows the reproduction of most software programs, games, and even motion pictures. Using the current pricing model, the country that buys the smallest number of copies pays a much smaller portion of the overall acquisition costs. For example if the sum of AC, CPC, and SC was \$800,000 and the quantities produced was 2000 copies, then the cost for an IETM is \$400 per copy. If Country A buys 100 copies and Country B only buys 10 copies and reproduces an additional 90 copies using commercial software at a cost of \$10 per copy, then Country A has spent \$40,000 for IETMs, while Country B has only spent \$4,900 for the same quantity of IETMs. This example may sound unethical or even dishonest, but in reality, this is a way to reduce costs for acquiring IETMs under the current system. A more reasonable way to allocate costs would be to divide the sum of AC, CPC, and SC by the number of participants acquiring IETMs. The cost of CD-ROMs and DVDs are almost irrelevant. Currently, in the commercial marketplace, the median price of blank CD-ROMs in a bundle costs \$0.25 and blank DVDs costs \$0.93 in a bundle. The largest portion of CPC is the labor involved in loading the CDs or DVDs into a computer or mass production machine and testing the copies to make sure that they work properly. A more accurate pricing structure for IETMs should be:

$$\frac{(AC + CPC + SC)}{N} = \text{Cost per participant}$$

N is equal to the number of countries participating in the acquisition of the IETM. The cost of reproducing IETMs is almost irrelevant due to the low cost of CD-ROMs and

DVDs. The labor costs for making the copies is minimal because reproduction requires very little human interface. Is this policy fair to the countries that buy 100 weapons systems versus the countries that only buy 10 weapons systems? Yes, because each contract stands alone and the countries that made the larger purchases paid less per weapon system due to economies of scale and bulk purchase discounts. What about countries that want to acquire the IETM after the initial acquisition? They would pay the amount originally paid by each participant plus the additional CPC and that money would be distributed evenly among the original participants. For example, the sum of AC, CPC, and SC is \$800,000 and there are four countries participating in the initial acquisition, then the cost per country is \$200,000. If two additional countries would like copies of the IETM, then they would have to pay \$200,000 each plus any additional CPC. The money would be redistributed among the original participants, thus lowering their costs to \$100,000 for being an original participant.

B. WEB-BASED IETM DISTRIBUTION

For web-based IETMs, the pricing model should be cost per participant plus a subscription cost. The cost per participant was discussed in the preceding section, but the subscription costs should be allocated based on the sum of the variables described below:

Hosting and Maintenance Costs (HMC) are the costs to store, maintain, and backup the data on a network server. In addition to storage and management of the data, the company must distribute the data via the internet through a network or series of networks that would require large amounts of bandwidth to facilitate access and download of substantial segments of data.

Domain Name Registration Cost (DNC) is the annual cost to maintain your domain name so that visitors can find your website. This fee is also paid so that the IP address for your domain name can be disseminated throughout the internet.

Search Engine Registration Cost (SERC) is the cost to register your site on various search engines. Some of the top search engines include Google, Lycos, MSN, Yahoo, Excite, and AltaVista. Each search engine charges a different fee depending on express or superior listing, while some search engines charge on per click basis, meaning you only pay the search engine when someone visits your website using that search engine.

$$\text{Subscription Costs} = \frac{(\text{HMC} + \text{DNC} + \text{SERC})}{S}$$

S is the number of subscribers

C. WEB BASED DISTRIBUTION PRICING MODEL

$$\frac{(\text{AC} + \text{CPC} + \text{SC})}{N} - \text{FUNDS COLLECTED FROM NEW PARTICIPANTS PURCHASING IETMs} + \frac{(\text{HMC} + \text{DNC} + \text{SERC})}{S}$$

This model captures all the pertinent costs connected with the acquisition of IETMs using the internet as a means of distributing and updating data.

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IV. CONCLUSION AND RECOMMENDATIONS

A. CONCLUSION

Foreign customers often complain that the FMS program is expensive and ambiguous. Also, the price fluctuations during the entire life cycle of some FMS cases often frustrate some buyers because it is difficult for them to justify the significant increase from the original negotiated figures to their governmental hierarchy. Foreign customers want to actively participate in the negotiations of procurements with commercial companies. Technology provides an opportunity for foreign governments to assume a more active role in the negotiation phase of the procurement cycle; however, once a country wants to aggressively participate in negotiations, then that country should transition to DCS instead of using the FMS Program.

As we transition from strictly face-to-face personal negotiations to more sophisticated electronic media, such as video teleconferencing and live internet broadcasts, the costs associated with this migration will differ considerably. With the introduction of these new technologies, various fees associated with this transformation have to be incorporated into the pricing structure that currently exists. As electronic storage and presentation of digital data becomes more interactive with the internet, the link between the existing practices and advanced products become more contradictory. Historical pricing procedures will no longer reflect the costs that need to be recovered. The problem that exists with the incorporation of these fees is the lack of long term historical data due to the relative infancy of the goods and services linked to new and emerging technologies. The accuracy and reasonableness of commercial pricing for various goods and services in government contracting are determined by the adequacy of competition. In the absence of sufficient competition, government contractors must conduct thorough research and analyze the marketplace to determine a fair and reasonable pricing policy for all procurements using an assortment of methods that include cost analysis and independent cost estimates.

The Foreign Military Financing (FMF) program provides grants and loans to assist qualified countries in purchasing US weapons, equipment, defense services, and training. FMF can be used for both FMS and Direct Commercial Sales (DCS). Some

foreign customers compare FMS and DCS and, in most cases, FMS is usually considerably higher.²⁵ FMS costs more than DCS due to compliance with government regulations, oversight, and the cost of maintaining professional acquisition personnel and the corresponding infrastructure. In addition to the high costs associated with FMS, the government surcharges and other embedded charges are often viewed by customers as superfluous and pricey. Foreign customers are responsible for all costs associated with FMS as well as all charges that surpass the initial LOA. This presents a dilemma to foreign buyers because they are at the mercy of contractors who have little incentive to control costs.

The US Government has significant control of power, information, and time in the realm of FMS. Many smaller nations join the FMS program to establish closer economic ties with the US. Information is disseminated on a limited basis to FMS customers, especially detailed pricing data. The internet can and will play a major role in the restructuring of the FMS program. Everything from web-based document distribution to wireless laptops at field units will be derived and implemented from the internet. The transfer of large streams of data to various nodes within a network will be vital to maintaining the current network centric warfare posture.

In conclusion, contracting officers must uphold their fiduciary responsibility by seeking the best value for the government. The practices of the commercial world have become more flexible over the years to address the ever evolving global economy. Contracting Officers will need to adapt current procedures to reflect the market conditions. The FMS program, as well as the entire government acquisition system, has been under increasing pressure to modernize many of its current practices to mirror commercial industry practices. In this free market and bureaucratic system, change is almost always met with some resistance; however, without change, there is no progress. In any business transaction, prudence must be present to ensure that the vital interests of all parties involved are met in an ethical and professional manner.

²⁵ Hamre, John, "Process Transparency White Paper" January 1999

B. RECOMMENDATIONS

Establish a solid vendor base and separate the vendors according to classes of electronic technical manuals.

By establishing a solid vendor base separated by class proficiency, two key accomplishments are achieved, substantial improvements in the learning curve and reduction in price due to adequate competition. Many business industry experts have exempted the learning curve measurements usually reserved for the manufacturing process from the software development field. With the ever condensing life cycle of software and increasing costs to prevent obsolescence, some model should be developed to accurately capture the software learning curve. Class 1-3 IETMs involve less programming and integration. They are relatively straightforward to create and require less skilled labor. This vendor base would be the largest and should provide the government with the best prices due to greater competition. Once competition is optimized, then the government should begin to establish reliable, long term relationships from a dependable vendor base, which should be an integral part of the overall acquisition strategy.

Class 4-5 IETMs call for more complex requirements and infrastructure. These tech manuals are developmental items and have all the complexities of major programs except the dollar value. Highly skilled programmers, complex computer equipment, costly digital audio/visual equipment, and integration software are just some of the requirements associated with creating Class 4-5 IETMs. This vendor base will be significantly smaller with less competition due to the tremendous amount of overhead associated with this operation. Intricate equipment and an erratic labor force will present barriers to entry for many of the potential smaller competitors. Responsibility determinations will be crucial in establishing the competitive range for this vendor base. Companies in the competitive range must be able to retain the highly skilled labor force associated with the requirements by ensuring they obtain adequate sales for continuous revenue to keep them profitable and capable of offering generous compensation packages to their workers.

In addition to separating vendors by IETM Class, establish a second tier for vendors that can provide an all inclusive solution (CD-ROMS, web-based distribution,

wireless distribution, etc..). This would allow the Government to receive some cost savings due to the consolidation of services and eliminate the requirement to create separate contracts for the different services.

There are potential problems associated with the vendor base. Once the competitive range is reduced, then the prices for end products could slowly begin to rise due to reduced competition. The instability of the labor force and the associated variance will be the largest determinant in maintaining a healthy vendor base. Some of the programmers operate as independent contractors and have no loyalties or long term vested interests in the companies that hire them; therefore, it is imperative that labor rates be established to satisfy the technical experts working on these projects. A forward pricing schedule for labor could be implemented to alleviate some of the variance and volatility in the labor market. The schedule should be adjusted on a biannual basis to reflect current market conditions. The proposed second tier of vendors could come under fire due to Small Business and other socio-economic program concerns because it could be viewed as contract bundling. The best value concept, specifically weighted guidelines and source selection criteria must be written to obtain the end user's requirements, while being fair and reasonable to the entire vendor base.

Mandate the use of a single programming language that is most widely used by industry and make that the standard for all Government IETMs.

The commercial industry has made tremendous strides in standardizing data structure and format over recent years. The Institute of Electrical and Electronics Engineers has been an organization leading the change to a universal software programming system. The use of a common language that is used by both Government and industry would significantly reduce data conversion costs because this would be the first step in eliminating diverse legacy systems. Once all systems are created using the same programming language and standards, updating systems would become effortless. A universal update could be disseminated across all Government systems via the internet, wireless connection, or CD-ROM. This is a small portion of the software systems that the Government acquires on a continuous basis; however, there could be significant cost savings by adopting this policy for all IETMs.

Decrease the overall costs for acquisition by utilizing the appropriate contract type.

Cost Plus Incentive Fee contracts should be used for the procurement of Class 4-5 electronic technical manuals and Firm Fixed Price for Class 3 and below. Using a firm fixed price contract for Class 3 and below will encourage the contractor to control costs because most of the risk is placed on the company. The research and development costs are incorporated in the software cost. Procurement officials should steer away from proprietary and developmental software. To save some acquisition costs, the contractor should not pay contractors to acquire new software, unless the requirements dictate a directed source or software format. Total costs for software should not be absorbed by the government because the software can be reused by the contractor to complete other assignments. Contractors will claim that future work is not guaranteed and it is unreasonable for the government to pay only a prorated portion of the software costs for government unique IETMs.

The government should verify that the contractor is proficient with the latest and most widely used software available on the market prior to award. A software expert within the government should be accessible to the IPT for this acquisition. The software costs should be allocated based on the life expectancy of the software, usually between five and ten years according to ePlantData.²⁶ Equipment and software are sunk costs for the contractor; therefore, the contractor should not be allowed to allocate these costs disproportionately into FMS contracts due to the long lead time and substantial administrative minutia for FMS procurements. If the contractor has to acquire software, then the government should only allow site licenses for the maximum number of programmers and that can work simultaneously. For example, the contractor has sixteen programmers but the contractor only has the capacity for eight programmers per shift, then the contractor could argue that he needs sixteen site licenses because that is the number of programmers outlined in his statement of work. The contractor should only purchase eight licenses because his maximum site capacity is eight programmers per shift and the licenses should be purchased in the name of the company, not the individual.

²⁶ <http://www.eplantdata.com>, "ePlantData Software, May 2001

For more complex IETMs, the costs could grow substantially due to the volatility of the labor market and the complexity of the requirement. Class 4 and 5 IETMs require an abundance of audio and video integration. The complexity of these requirements and the inherent risk associated with developmental items could have significant impacts in the overall costs. This initiative will also close the growing gap between the costs of FMS and DCS contracts.

Utilize the internet, especially in the electronic commerce market, to reduce administrative costs and reduce processing time in the FMS program.

There is already an existing infrastructure in the realm of electronic commerce and FMS. Many initiatives are currently in place and are being proposed to give foreign customers a more participatory role in the FMS acquisition process. Processes such as electronic LOA coordination have already begun and significant reductions in the processing time have been achieved. The Defense Security Assistance Development Center in conjunction with the Defense Security Assistance Management System conducted thirty nine successful transactions utilizing electronic LOAs. The average processing time using this new business technique was five days, condensed from the standard ten to sixteen day timeframe using paper documents.²⁷ This is just one example of the countless possibilities that exist with internet based electronic commerce. The drawback with the internet is the loss of interpersonal relationships. In many foreign cultures, the interpersonal relationships aid and transcend into the business domain. Although the internet is an excellent tool for conducting business, government contracting officers must not forget the fundamental principles for which the FMS program was established, that is, to strengthen alliances as well as form new ones. Finally, the FMS program must always seek to increase the influence of the US Government and protect the vital interests of the American economic system.

C. AREAS OF FURTHER RESEARCH

Make vs Buy Class 1-3 IETMs

The government has the infrastructure and personnel to produce Class 1-3 IETMs. Acquisition reforms mandate that the government should not compete with the commercial marketplace in producing goods and services. The volatility of the labor

²⁷ Beauchamp, Frederick, "Reinvention: Transforming FMS for the 21st Century", September 2001

force in the software development arena and the scarcity of resources for some foreign countries should be enough to at least examine the difference in costs between Class 1-3 IETMs being produced by the government and the commercial sector. Also, the possibilities of a hybrid acquisition where some of the labor is outsourced, but all the equipment for producing IETMs are government furnished property. These are just a few ideas that could be explored further.

Software price estimating model

A software price estimating model using complex mathematical algorithms and price indexes could be developed for all government IT purchases. Currently, there is no universal model to accurately price commercial software and software development for the government. Research could be conducted to analyze various pricing structures and cost analysis to generate a cost model to reduce the margin of error between initial estimates and final costs for software. Identification of key cost drivers and cost variables will be vital in establishing a universally accepted model.

Cost-benefit analysis of using a single programming language for all software acquisitions

The biggest problem the government faces when trying to implement a new software system across different agencies is the consolidation of numerous databases. The propagation of an assortment of databases is the result of individual agencies attempting to improve internal efficiency and effectiveness. By adopting a policy for a universal programming language for all software acquisitions, there are several potential cost savings. Ease of integration with other systems, economies of scale, and learning curve improvements are some of the ways that cost savings can be achieved. A cost-benefit analysis could identify reasons adopting this policy is feasible and achievable.

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